O&M costs are relatively low for medium-Btu gas projects. The gas consumer is usually responsible for the O&M of its own fuel-burning equipment. For the project developer, gas delivery system O&M expenses might include pipeline marking costs (to prevent pipeline rupture during excavations), labor costs, insurance, and property taxes. The Wilder's Grove landfill gas project in North Carolina reports that its only routine gas delivery system maintenance tasks are to clean the automated condensate drain filter and replace the pumping station filter when significant pressure drops occur [Augenstein and Pacey, 1992]. Gas collection system O&M costs are calculated to be about $0.31 per MMBtu in 1996 dollars [EPA, 1993].

5.3.3 Step 3: Compare Project Expenses and Revenues

To evaluate the economics of selling medium-Btu gas, the expenses associated with collecting, processing, and delivering the landfill gas must be compared against the gas revenues. A first-year comparison can give a quick estimate of project economic feasibility, while a pro forma model of cash flows will provide a more precise model of economic performance.

Using the capital cost assumptions described in Table 5-6, the first year cost of producing a medium-Btu fuel for direct use can be calculated for the example 5 million metric ton landfill. The results are presented in Table 5-7. Costs are displayed in the example for a baseload gas user, who consumes gas at a relatively constant rate over the course of a day or year, and a heat load user, who consumes gas mainly for seasonal heating needs. The results of the cost calculations affirm the following conclusions about medium-Btu gas projects in general:

- The incremental cost of installing a gas delivery system is very low. For the example landfill, the cost of the gas delivery system represents only about 23% of the total capital requirement.

- The fuel consumption pattern of a potential gas customer greatly affects the unit cost of gas. The example shows that producing and delivering gas to a heat load only customer would cost over twice that of producing and delivering to a baseload customer ($2.87 per MMBtu versus $1.28 per MMBtu on a total system basis).

- IRS Section 29 tax credits can make a substantial difference in offsetting gas production costs. When the full benefit of tax credits is factored into the cost of an incremental gas delivery system, the gas can essentially be recovered for free.

5.3.4 Steps 4 and 5: Create a Pro Forma and Assess Economic Feasibility

As with landfill gas power projects, the next steps in the project development process are to create a pro forma and assess economic feasibility. The concepts for analyzing a medium-Btu gas project are the same as those for a power project:

Step 4: **Create a pro forma** that includes a listing of financial assumptions and perating parameters, energy pricing data, calculation of annual expenses and revenues, an income statement, a cash flow statement, and financial results.

Table 5.7 Estimated Cost of Producing Medium-BTU Gas at Example Landfill

Example: Landfill waste in place = 5 million metric tons

Cost Category	Units	Baseload user (continuous)	Heat load user (seasonal)
GAS PRODUCTION COSTS			
Capital Costs (as-spent, 1996 online)			
Total capital requirement	$/MMBtu	6.92	15.56
Incremental capital requirement	$/MMBtu	1.57	3.53
O&M Costs (1996)			
LFG collection system	$/MMBtu	0.31	0.70
Gas delivery system	$/MMBtu	0.02	0.06
Tax Credit (1996)	$/MMBtu	1.049	1.049
FIRST YEAR COST OF GAS (1996)			
Capital charge rate		0.136	0.136
Total Gas Cost			
Levelized capacity price	$/MMBtu	0.94	2.12
1996 O&M price	$/MMBtu	0.34	0.75
Total 1996 cost of gas	$/MMBtu	1.28	2.87
Cost of gas including tax credit	$/MMBtu	0.23	1.82
Incremental Gas Cost (a)			
Levelized capacity price	$/MMBtu	0.21	0.48
1996 O&M price	$/MMBtu	0.02	0.06
Total 1996 cost of gas	$/MMBtu	0.24	0.53
Cost of gas including tax credit	$/MMBtu	(0.81)	(0.51)

Notes:

See Chapter Appendix for notes on these calculations.

(a) Incremental Gas Cost does not include capital and O&M costs associated with LFG collection system.

Step 5: **Assess economic feasibility** based on cash flows, debt coverage ratios, owner's ROR, and NPV of cash flows.

5.4 ALTERNATIVE OPTIONS

Although the conventional power generation option and the medium-Btu gas sales option account for the vast majority of landfill gas energy recovery projects, there are several additional gas use alternatives that may be worth exploring. These alternatives, described briefly below, include: upgrading landfill gas to pipeline quality gas; using landfill gas as a vehicle fuel; using landfill gas in niche applications; and using landfill gas in fuel cells.

5.4.1 Upgrade to Pipeline Quality Gas

Upgrading gas to pipeline quality is relatively expensive, because of substantial processing requirements to remove nitrogen and other constituents of raw landfill gas. This option is currently viable only at larger landfills (i.e., more than 4 million cf per day) where significant economies of scale can be achieved. Landfill gas developers report that the revenues required to support such a project are in the range of $3.62 to $4.14 per MMBtu (1994$) [SCS Engineers, 1994]. Tax credits, such as IRS Section 29 credits, may be available to qualifying projects to help the economics of this type of project. Higher natural gas prices would increase the attractiveness of this option.

Local distribution companies (LDCs) are the best potential market for upgraded gas sales, because they have a large existing market for the gas. The price an LDC will pay for upgraded landfill gas will probably be based on the price it pays for natural gas from producers and gas marketers. There are many different pricing methods used by LDCs. One of the most common is to index the gas price to the monthly market, or "spot," price. Spot prices vary among geographic areas and pipeline systems, and they fluctuate month-to-month. In the last few years, spot prices have been low due to a glut of natural gas supply on the market. Although this glut is disappearing, gas prices are not expected to increase dramatically in the next few years. LDCs may require gas testing for certain constituents, and assurances that these constituents will be removed or kept to a very low level.

5.4.2 Vehicle Fuel Applications

There are a few potential vehicle fuel applications for landfill gas — compressed natural gas (CNG), liquified natural gas, and methanol — that are in the early stages of development or commercialization. At this time, CNG and other alternate-fuel vehicles make up a very small percentage of automobiles in the U.S., so there is not a large demand for CNG as a vehicle fuel. Environmental regulations may increase demand; for example, in southern California and the Northeast, alternate-fuel vehicles are expected to become a way to reduce local ozone pollution. Recent federal regulations may favor methanol produced from a renewable source, such as landfill gas.

Cost savings can be realized for landfill owner/operators who own vehicles or other nearby fleets (e.g., municipal vehicles, delivery trucks) that can be converted to run on alternate fuels. Key factors in the economic evaluation of this option are: (1) the cost of installing a fueling station; and, (2) the costs of retrofitting vehicles to run on the alternate fuel. The cost of installing a compressed landfill gas fueling facility can be significant — the installation of the Puente Hills Landfill fueling station in California cost approximately $1 million [McCord, 1994]. However, under the Energy Policy Act of 1992, a federal tax deduction of up to $100,000 is available for the installation of alternate fueling stations [Webb, 1992; Adkins, 1995]. Vehicle conversion costs, which currently run about $3,500 for passenger vehicles and $4,000 for trucks, can also be offset by tax deductions.[8] Up to $2,000 per vehicle is available for conversions of conventional fuel vehicles and up to $5,000 per vehicle is available for medium-duty fleet purchases or conversions [GRI, 1995].

Fleet vehicles are an especially good application for alternate fuels because these vehicles usually travel less than 200 miles per day and they return to a central location at night for refueling and storage. Also, having a fleet of vehicles will increase fuel usage and therefore decrease average fuel costs, since capital recovery of fueling station construction costs represents the majority of fuel production costs (operation and maintenance costs for alternate fuel vehicle stations are minimal). For example, fuel costs at the Puente Hills CNG station range from 48¢ per gallon gasoline equivalent at a 100 percent station utilization factor to $1.26 per gallon gasoline equivalent at a 25 percent station utilization factor [Wheless, Thalenburg, Wang, 1993].

5.4.3 Fuel Cells

The use of fuel cells to chemically convert landfill gas to electricity is a promising application, largely because of the high efficiency and minimal emissions resulting from this process. At this time, use of fuel cells for landfill gas applications is in the demonstration phase.

The phosphoric acid fuel cell (PAFC) is one of the three types of fuel cells suitable for stationary power production. This technology is considered commercially viable today, for other fuels, and there are over 40 MW of PAFC demonstration units in operation [Swanekamp, 1995]. The capital cost of the PAFC unit is $3,000 per kW for delivery in 1995, and is projected to decrease to approximately $1,500 per kW by 1998 [Strait, Doorn, and Roe]. Variable O&M costs for the units are estimated to be 1.7¢/kWh [FCCG, 1993].

Landfill gas-powered fuel cells are in the demonstration phase. Northeast Utilities installed a test unit at the Flanders Road Landfill in Groton, Connecticut in late 1995, and operation at the site began in June, 1996. Northeast Utilities expected to spend $150,000 to install and maintain the 200 kW fuel cell. [Electric Power Daily, 1995]. Currently, Connecticut Light & Power, a subsidiary of Northeast Utilities, is operating and maintaining the test unit. The $1.5 million, 200-kW PAFC demonstration unit, owned by the EPA, has already been tested at the Penrose Landfill in Sun Valley, CA.

5.4.4 Niche Applications

An important alternative application, particularly for smaller and/or closed landfills, is the local use of landfill gas for niche applications such as heating of greenhouses. Where these applications are available, they may be the most economically attractive for landfills that fail the economic tests of traditional applications. The costs of these applications will vary, depending

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[8] Note that the tax deduction applies to the conversion of vehicles to various alternate fuels (e.g., CNG, LNG, LPG, or methanol).

on type of equipment used. For example, if landfill gas is used in an existing natural gas boiler to heat a greenhouse, costs may be minimal if burner adjustment is all that is required.

Other niche applications are currently being developed, such as the use of landfill gas to produce commercial high purity carbon dioxide (CO_2). With retail prices for this product between $50 and $200 per ton (1992$), this may become a valuable use of landfill gas [Strait, Doom, and Roe]. The process used to recover landfill gas CO_2 is in the field-scale testing and demonstration phase.

5.5 COMPARISON OF ALL ECONOMICALLY-FEASIBLE OPTIONS

If a landfill owner/operator has the opportunity to produce and sell more than one type of energy product, he or she should compare the net cash flows of each option head-to-head to determine the best option, as illustrated in Figure 5.2. After completing an initial economic analysis for each option, including the development of a pro forma for the most promising options, the owner/operator can compare the results of the economic analysis (Step 5). After ranking the options and selecting an economic winner, the landfill owner/operator should then consider non-price factors including risks, ability to obtain financial backing, environmental performance, and reliability of assumptions. The option that produces the best financial performance while meeting the desired environmental, risk, and operating requirements is the winner.

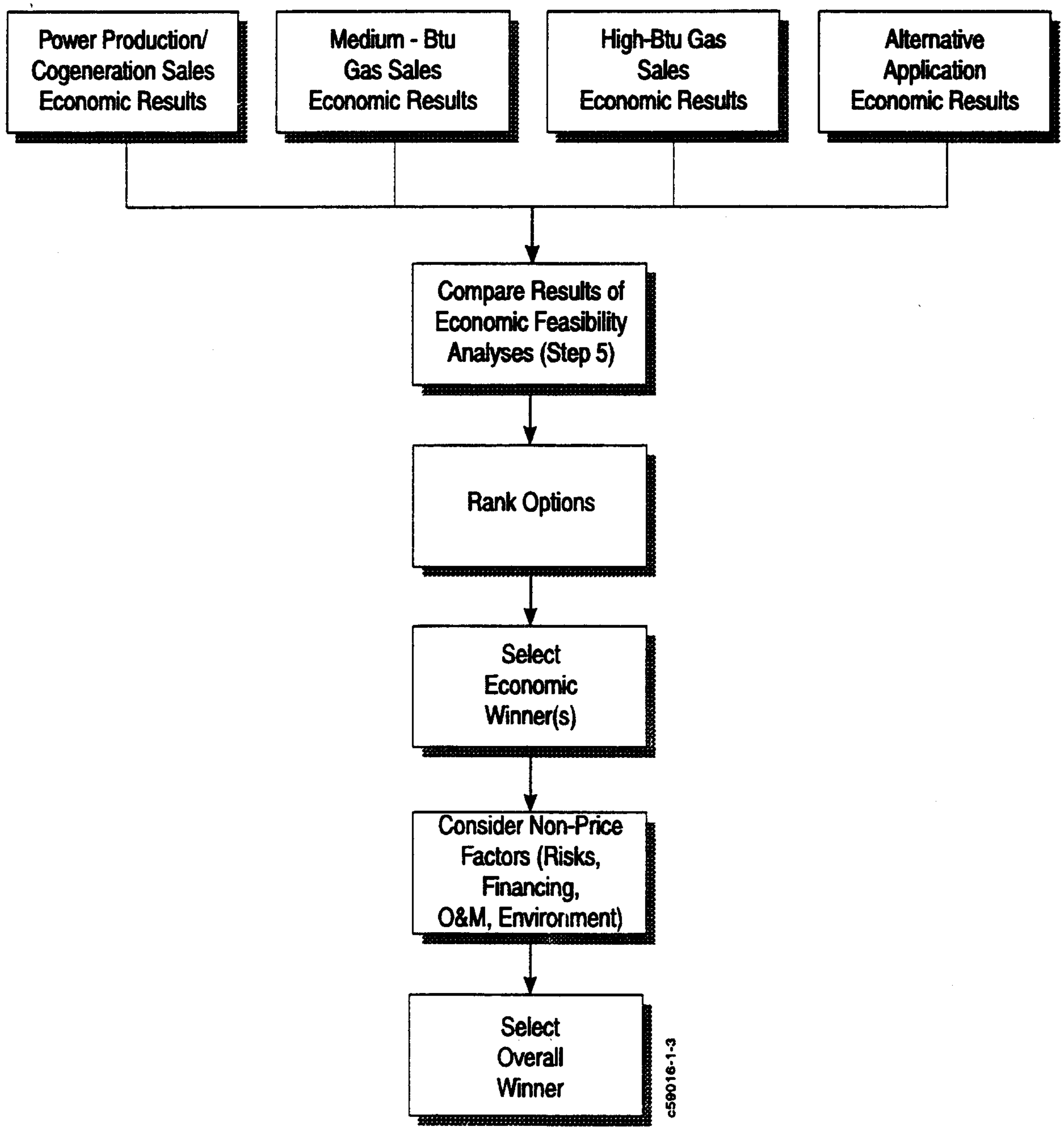
5.5.1 Head-to-Head Economic Comparison

The results of Step 5 of the economic analysis — annual cash flows, NPV, debt coverage, and ROR — can be used independently or together to rank options and select an economic winner. There is no single measure of financial performance that guarantees economic viability, so it is wise to consider several measures together. One approach is to rank options according to the NPV of future after-tax cash flow, making sure that minimum debt coverage and ROR requirements are also met. The option with the highest NPV that meets the minimum debt coverage and rate of return requirements is the economic winner.

5.5.2 Consideration of Non-Price Factors

Although economic feasibility and financial results are important, the final selection of the project technology and configuration should take into account non-price factors such as environmental performance, reliability, and accuracy of assumptions. In the power generation example used above, the IC engine produced the maximum income for the owner, but the use of a CT may still be more attractive if low nitrogen oxide (NO_x) emissions are a priority (see Chapter 9). The permitting process might determine that low NO_x emission levels are required, potentially making the IC engine more expensive and/or more difficult to permit than the CT. As another example, a medium-Btu gas sale may show superior economic results when compared to the power generation options, but there may be additional risks entailed in pipeline construction or boiler conversion. Non-price factors have real impacts on project viability and must be taken into consideration.

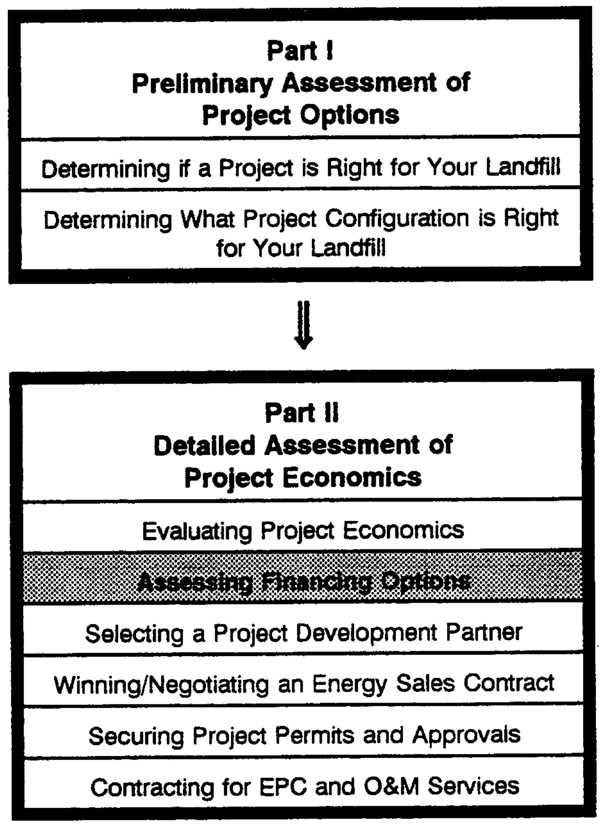
Figure 5-2 Deciding Among Energy Project Options



6. ASSESSING FINANCING OPTIONS

Financing a landfill gas energy recovery project is one of the most important and challenging tasks facing a landfill owner or project developer. A number of potential financing avenues are available, including finding equity investors, using project finance, and issuing municipal bonds. This chapter provides insights into what lenders and investors look for under each financing method, how to secure financing, and some advantages and disadvantages of each method.

The Project Development Process



The following six general categories of financing methods may be available to landfill gas projects:

(1) private equity financing
(2) private nonrecourse debt financing (i.e., "project financing")
(3) municipal bond financing
(4) direct municipal funding
(5) lease financing
(6) public financing through institutional or public stock offerings

The first four types are common among smaller energy projects such as landfill gas projects. Of the last two types, lease financing is used occasionally and public financing is not commonly used for landfill gas projects, but landfill owners should be aware that they exist. A recent survey of landfill gas energy projects concluded that private debt or equity financing was used in 85% of the cases [Berenyi and Gould, 1994]. The same survey showed that over 10% of the projects were funded directly by city, county, or other municipal revenues.

The selection of financing method is usually driven by cost and applicability, since not all financing methods are available to all types of projects and project owners. A flow chart that illustrates the general process of deciding on the optimal financing method is presented in Figure 6.1. The cost effects of various financing methods are illustrated in Figure 6.2, which shows a sample capacity price for the same project under different financing methods. The capacity price incorporates the cost of building and financing a landfill gas project, annualized over the project life. It is sensitive to interest rates; higher interest rates lead to higher financing costs and a more expensive project compared with a lower interest rate scenario.

From the landfill owner's perspective, often the simplest and lowest cost financing method is to use direct municipal funding through the municipal operating budget. Because the

Figure 6-1: Assessing Financing Options

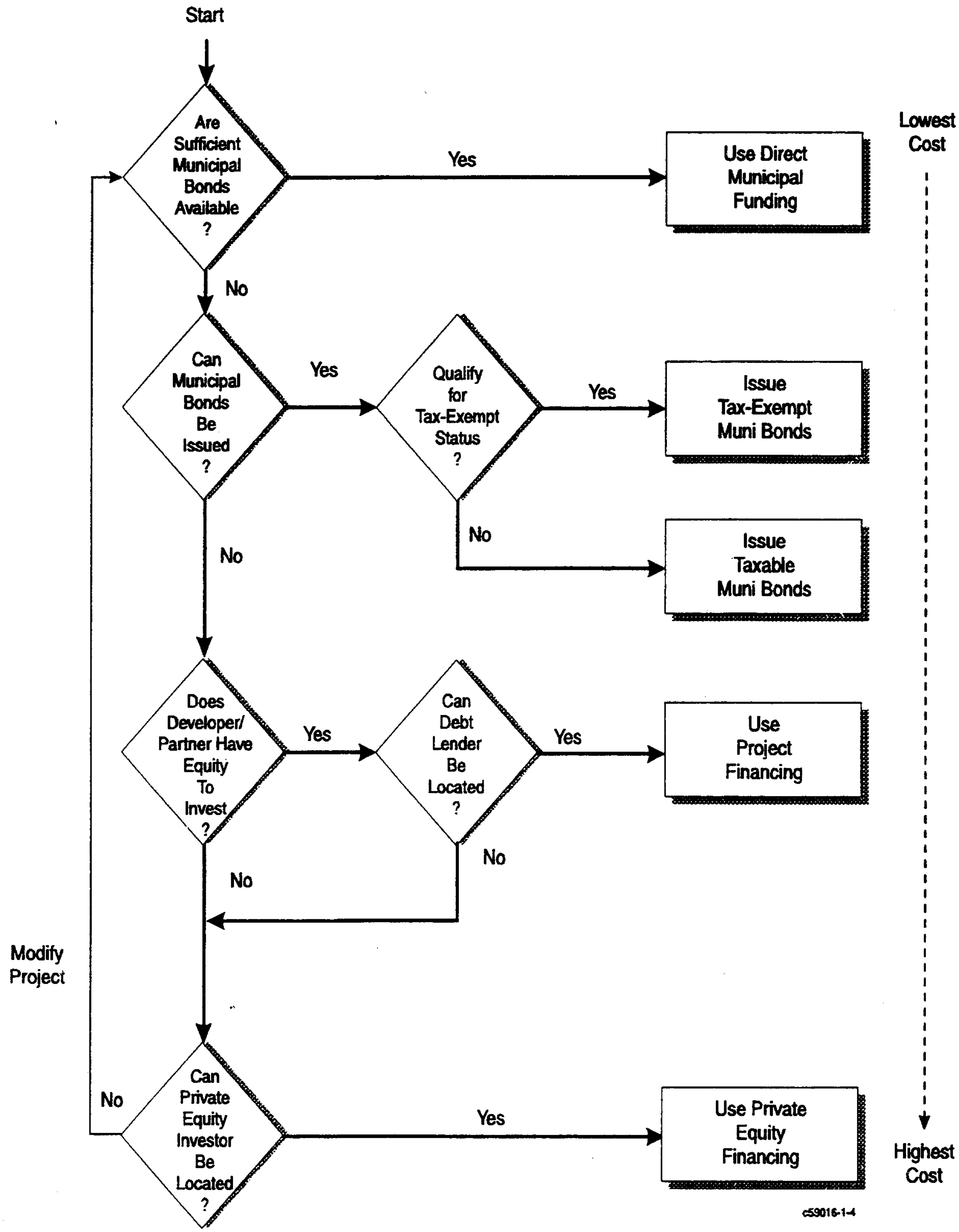
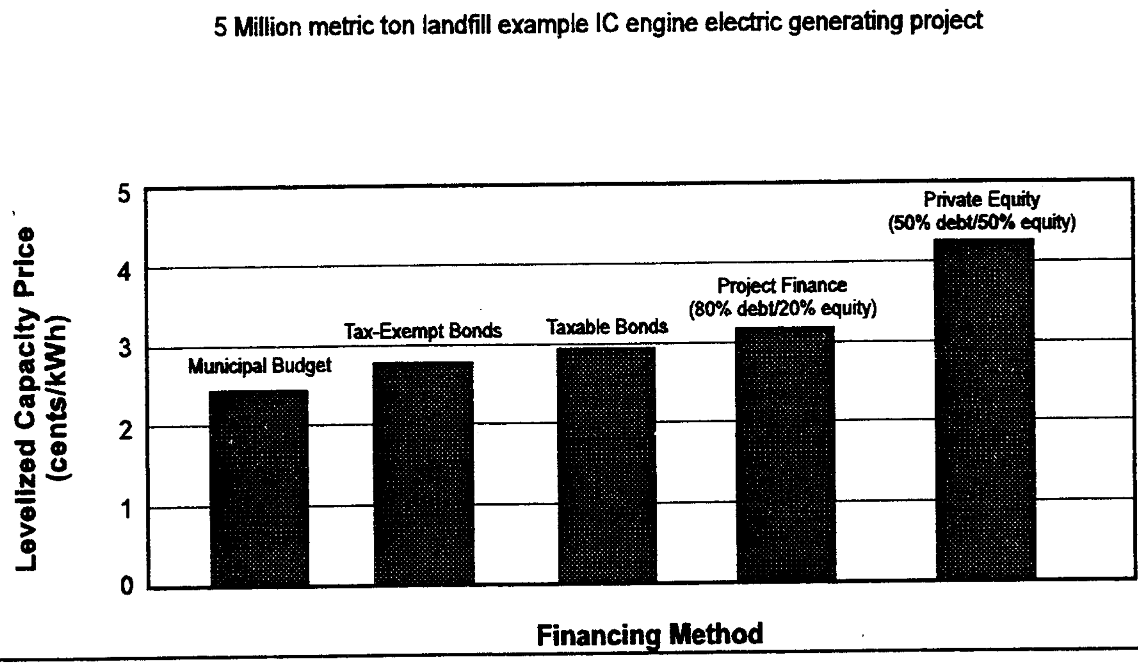


Figure 6-2: Capacity Price Produced by Different Financing Approaches



amount of municipal funds available is usually limited, however, this method may not be possible for many projects. Issuing municipal bonds is also a low-cost option, particularly for projects owned by a public agency, but local and federal applicability rules must be satisfied in order to use this method. If neither of these options is viable, then the project must look to higher-cost debt or private equity for financing. Selecting a developer with equity to invest or a demonstrated ability to obtain financing for landfill gas projects is a convenient strategy for landfill owners exploring these financing options.

6.1 FINANCING: WHAT LENDERS/INVESTORS LOOK FOR

Most lenders and investors decide whether or not to lend to or invest in a landfill gas project based on the expected financial performance of the project. Financial performance is usually evaluated using a pro forma model of project cash flows (discussed in Chapter 5). Thus, preparing a detailed pro forma is an important step in ensuring the financial feasibility of a landfill gas energy project.

A lender seeking demonstration of project financial strength will usually examine the following measures:

- Debt coverage ratio — The lender's main measure of project financial strength is the ability of a project to adequately meet debt payments. Debt coverage ratio is the ratio of operating income to debt service requirement and is usually calculated on an annual basis. Debt coverage ratios are usually expected to be in the 1.3 to 1.5 range.

- Owner's rate of return (ROR) on equity — The desired ROR currently ranges from about 12% to 18% for most types of power projects. Outside equity investors will typically expect a ROR of 15% to 20% or more, depending mainly on the project risk profile. These RORs reflect early-stage investment situations;

investments that are made later in the development or operation phases of the project typically receive lower returns because the risks have been substantially reduced.

The feasibility of a particular landfill gas energy project is also determined by the quality of supporting project contracts and permits, and by risk allocation among project participants. The uncertainties about whether a power project will perform as expected or whether assumptions will match reality are viewed as risks. To the extent possible, the project's costs, revenues, and risk allocation are spelled out through contracts with energy purchasers, equipment suppliers, fuel/landfill gas suppliers, engineering/construction firms, and operating firms, as well as through the presence of permits, developer experience, and financial commitments. Table 6-1 summarizes the principal project risk categories, viewed from the beginning of the development process, and presents possible risk mitigation strategies, the most important of which are usually obtaining contract(s) securing project revenues and verification of landfill gas availability. Potential lenders and investors will look to see how the project developer has addressed each risk through contracts, permitting actions, project structure, or financial strategies.

6.2 FINANCING APPROACHES

Capital for landfill gas energy projects is most commonly obtained from private equity financing, project financing, municipal bonds, or direct municipal funds. This section focuses on the lenders' requirements, the means of securing financing, and the advantages and disadvantages of each of the four major financing approaches. Two other potential financing methods — lease financing and public debt financing — are also discussed briefly.

6.2.1 Private Equity Financing

Historically, private equity financing has been one of the most widely used methods of financing landfill gas energy projects. In order to use private equity financing, an investor must be located who is willing to take an ownership position in the landfill gas energy project. In return for a significant share of project ownership, the investor is willing to fund part or all of the project costs using its own equity or privately placed equity or debt. Some landfill gas developers are potential equity investor/partners, as are some equipment vendors, fuel suppliers, and industrial companies. Investment banks are also potential investors. The advantages and disadvantages of private equity financing are presented in Box 6.1. The primary advantage of this method is its availability to most projects; the primary disadvantage is its high cost.

Equity investors typically provide equity or subordinated debt for projects. Equity is invested capital that creates ownership in the project, like a down-payment in a home mortgage. Equity is more expensive than debt, because the equity investor accepts more risk than the debt lender. (Debt lenders usually require that they be paid before project earnings get distributed to equity investors.) Thus the cost of financing with equity is usually significantly higher than financing with debt. Subordinated debt gets repaid after any senior debt lenders are paid and before equity investors are paid. Subordinated debt is sometimes viewed as an equity-equivalent by senior lenders, especially if provided by a credit-worthy equipment vendor or industrial company partner.

Table 6-1 Addressing Landfill Gas Energy Project Risks

Risk Category	Risk Mitigation Measure
Landfill gas availability	• Drill test wells, monitor samples • Hire expert to report on gas availability • Model gas production over time • Execute gas delivery contract/penalties with landfill owner • Provide for back-up fuel if necessary
Construction	• Execute fixed-price turnkey contracts • Include monetary penalties for missing schedule • Establish project acceptance standards, warranties
Equipment performance	• Select proven technology • Design for landfill gas Btu content • Design to take landfill gas impurities into account • Get performance guarantees, warranties from vendor • Include major equipment vendor as partner • Select qualified operator
Environmental permitting	• Obtain permits prior to financing (air, water, building) • Plan for condensate disposal
Community acceptance	• Purchase site, sign lease, execute option agreement • Obtain zoning approvals • Demonstrate community support
Power sales agreement (PSA)	• Have signed PSA with local utility, or industrial plant • Match PSA pricing, escalation to project expenses • Where possible, get capacity payment to cover fixed costs • Get sufficient term to match debt repayment schedule • Confirm interconnection point, access, requirements • Make sure online date is achievable • Include force majeure provisions in PSA
Energy sales agreements	• Match energy pricing and escalation to project costs • Limit liability for interruptions, have back-up • Include industrial firm, fuel company as partner (see PSA items above)
Financial performance	• Create financial pro forma • Calculate cash flows, debt coverages • Commit equity to the project • Ensure robust ROR • Maintain working capital, reserve accounts • Budget for major equipment overhauls

Box 6-1 Private Equity Financing — Advantages/Disadvantages

Advantages

- For some power projects under 20 MW without access to municipal bonds, this may be the only means of obtaining financing.
- Transaction costs are usually less than with project financing or bond financing.
- Equity partners can often move faster than commercial lending institutions, enabling tight project schedules to be met.
- Bringing in an equity or subordinated debt partner is an effective means of risk-sharing, provided that the risk allocation is reflected in the project structure.

Disadvantages

- Equity is expensive; returns on equity will be paid to the investor out of project cash flows.
- Project owners will have to give up some project ownership and control to an equity investor.
- The addition of a subordinated debt partner can complicate the financing process if project financing is being used.
- A partner who is an equipment vendor, fuel company, or industrial company might have different objectives than the landfill owner (e.g., operation for optimum emissions control may not be a priority).

Investor's Requirements

The equity investor will conduct a thorough due diligence analysis to assess the likely ROR associated with the project. This analysis is similar in scope to banks' analyses, but is often accomplished in much less time because of the entrepreneurial nature of equity investors as compared to institutional lenders. The equity investor's due diligence analysis will typically include a review of contracts, project participants, equity commitments, permitting status, technology and market factors. The key requirement for most pure equity investors is sufficient ROR on their investment. The due diligence analysis, combined with the cost and operating data for the project, will enable the investor to calculate the project's financial performance (e.g., cash flows, ROR) and determine its investment offer based on anticipated returns. An equity investor may be willing to finance up to 100% of the project's installed cost, often with the expectation that additional equity or debt investors will be located later.

Some types of partners that might provide equity or subordinated debt may have unique requirements. Potential partners such as equipment vendors, fuel suppliers, and industrial companies generally expect to realize some benefit other than just cash flow. The desired benefits may include equipment sales, service contracts, tax benefits, and economical and reliable energy supplies. For example, an engine vendor may provide equity or subordinated debt up to the value of the engine equipment, with the expectation of selling out its interest after the project is built. A fuel supplier might also become an equity partner to gain access to a low-cost gas supply, or a nearby industrial company might want to gain access to fuel or derived energy. The requirements imposed by each of these potential investors are sure to include not only an analysis of the technical and financial viability, but also a consideration of the unique objectives of each investor.

Securing Private Equity Financing

To fully explore the possibilities for private equity or subordinated debt financing, landfill owners should ask potential developers if this is a service they can provide. The second most common source of private equity financing is an investment bank that specializes in the private placement of equity and/or debt. Additionally, the equipment vendors, fuel companies, and industrial companies that are involved in the project may also be willing to provide financing for the project, at least through the construction phase. The ability to provide financing is often an important consideration when selecting a developer, equipment vendors, and/or other partners.

6.2.2 Project Finance

"Project finance" is a method for obtaining commercial debt financing for the construction of a facility, where lenders look at the credit-worthiness of the facility to ensure debt repayment rather than at the assets of the developer/sponsor. In most project finance cases, lenders will provide project debt for up to about 80% of the facility's installed cost and accept a debt repayment schedule over 8 to 15 years. Project finance usually provides the option of either a fixed rate loan or a floating rate loan, which is tied to an accepted interest rate index (e.g., U.S. treasury bills, London Interbank rate). Typically, the facility sponsor(s) will set up a separate subsidiary company to develop and manage the facility, and lenders in effect provide financing to the subsidiary company with limited or no recourse to the subsidiary's parent(s). Thus project financing is often known as "nonrecourse" financing because the project debt is secured by facility assets and contracts, with no recourse (or limited recourse) to parent companies should the facility experience financial under-performance or failure.

Most private power projects, especially those built in the last 15 years by third-party developers, were completed using project finance. The major advantages and disadvantages of project finance are listed in Box 6.2. The biggest advantage of project finance is the ability to use others' funds for financing, without giving up ownership control. The biggest disadvantages are the difficulty of obtaining project finance for landfill gas projects, which tend to be smaller than traditional power projects. In addition, project finance transactions are costly and often an onerous process of satisfying lenders' criteria.

Lenders' Requirements

In deciding whether or not to provide project finance to a power project, lenders examine not only the expected financial performance of the project; they also consider several other factors that underlie facility success such as contracts, project participants, equity stake, permits, technology, and sometimes market factors. A good candidate for project financing should have most, if not all, of the following:

Box 6-2 Project Finance — Advantages/Disadvantages

Advantages

- Project debt is usually nonrecourse to the landfill owner and/or energy project sponsor; however, the owner and sponsor remain liable for explicit warranties and misrepresentations.
- The project debt can usually be kept off the project sponsor's balance sheet.
- Project sponsors can retain sole or majority ownership of the landfill energy project.

Disadvantages

- The small capital requirements of landfill gas projects relative to other power projects can make project financing difficult to obtain, because transaction costs and risk perceptions remain high.
- Lenders usually require most key contracts and permits to be in place on or before financial closing, which adds to project lead time.
- Lenders may place other requirements on the project such as minimum equity contribution, minimum debt coverage, and creation of a major maintenance fund.
- Debt must usually be repaid over an 8 to 15 year term.

- Signed energy sales agreement from a creditworthy electricity or gas customer (e.g., utility, industrial, municipality)
- Fixed-price agreement with engineering/construction firm(s)
- Equity commitment
- Operation and maintenance agreement
- Fuel supply analysis and supply/transport agreement(s)
- Control of the project site (e.g., option agreement or ownership)
- Environmental permits
- Local permits/approval

In addition, lenders may place additional requirements on the project developers such as maintaining a certain minimum debt coverage ratio and making regular contributions to an equipment maintenance account, which will be used to fund major equipment overhauls.

In addition, in cases where project finance is used, lenders generally expect the project sponsors to make some equity commitment of their own. An equity commitment shows that project sponsors also have a financial stake in project success, and it implies that sponsors will be more likely to step in with additional funds if problems arise. The expected debt-equity ratio is usually a function of project risks. In the mid-1980s, some power projects obtained project financing with little or no equity contribution, based mainly on the financial strength of the project and supporting contracts. However, most lenders now do not accept such highly leveraged projects and instead require at least a 20% equity stake on the part of project sponsor(s).

Securing Project Financing

Landfill gas projects have historically experienced some difficulty securing project financing, because of their relatively small size and the perceived risks associated with the technology. In addition, the transaction costs for arranging project financing are relatively high, owing to the lender's extensive due diligence (i.e., financial and risk investigation) requirements; it is often said that the transaction costs may be the same for a 10 MW project as for a 100 MW project. For this reason, most of the project finance groups at the large commercial banks and investment houses hesitate to lend to projects with capital requirements less than about $20 million (or a 20 MW or larger power project).

The best opportunities for landfill gas projects to secure project financing are generally with the project finance groups at smaller investment capital companies and banks, or at one of several energy investment funds that commonly finance smaller projects. Some of these lenders have experience with landfill gas projects and may also be attuned to the unique needs of smaller projects. Depending on the project economics, some investment capital companies and energy funds may consider becoming an equity partner in the landfill gas project in addition to, or instead of, providing debt financing. Additionally, it is worth contacting local and regional commercial banks. Some of these banks have a history of providing debt financing for small energy projects, and may be willing to provide project financing to a "bundle" of two or more landfill gas projects.

6.2.3 Municipal Bond Financing

Municipally owned landfills occasionally issue taxpreferred municipal bonds to finance landfill gas energy projects. The biggest benefit of using this financing method is that the resulting debt has an interest rate that is often 1% to 2% below commercial debt or taxable bond debt (see Box 6.3). For a bond issue to qualify for tax-exempt status, a number of complex IRS conditions concerning project ownership and purpose must be met. Additionally, statespecific laws and policies may also impact the ability to issue tax-exempt bonds. Since the rules governing the applicability of tax-exempt bond financing are complex, it is wise to consult the IRS tax code and a tax expert before deciding on a particular approach.

The important factors in qualifying for and obtaining municipal bond financing are described below.

Lenders' Requirements

Generally speaking, a government entity (e.g., municipality, public utility district, county government) can issue either tax-exempt governmental bonds or private activity bonds, which can be either taxable or tax-exempt. Bonds can either be secured by general government revenues (i.e., revenue bonds), or by the specific revenues from the energy project (i.e., project bonds). The term for bond financing usually does not exceed the useful life of the facility; terms extending up to 30 years are not uncommon, however.

Box 6-3 Municipal Bond Financing — Advantages/Disadvantages

Advantages

- Tax exempt financing provides access to debt at interest rates that are 1% to 2% below the rates offered by commercial lenders.
- Debt repayment can be extended over the life of the facility, which may be 20 years or more.

Disadvantages

- The financial performance requirements (e.g., debt coverage, cash reserves) placed on the project by the bond issuer may exceed project finance lender's requirements.
- Public disclosure requirements exist.
- The project may have to contend with state caps on the amount of private activity bonds that can be issued.
- It is difficult to obtain additional capital for the project in cases where the design, equipment, or other conditions change.

In addition to initial qualification requirements, many tax-exempt bond issuers find that strict debt coverage and cash reserve requirements must be imposed on an energy project to ensure that the financial stability of the issuer is preserved. These requirements may be even more rigorous than those imposed by commercial banks under a project finance approach.

Securing Municipal Bond Financing

To qualify for a governmental bond issue, a project must meet at least two criteria:

(1) Private business use test — No more than 10% of the bond proceeds are to be used in the business of an entity other than a state or local government.

(2) Private security of payment test — No more than 10% of the payment of principal or interest on the bonds can be directly or indirectly secured by property used for private business use.

Under these rules, a government entity could issue tax-exempt governmental bonds to finance a landfill gas energy project if the project would be owned and operated by the same government entity. If private owners or operators are involved, however, the project may not qualify for tax-exempt governmental bond status [Snohomish, 1994; Martin, 1993]. Private business use can include private ownership of all or part of a landfill gas project.

If a particular project fails to qualify for a governmental bond issue, it may still achieve tax-exempt bond status through one of several exemptions for projects that provide some form of public benefit. Among these exemptions are at least two that could apply to certain landfill gas projects with partial private ownership [Kulakowski, 1994; Martin, 1993]:

> Local furnishing of electricity — Tax-exempt status is provided for a power project that sells electricity to a utility (public or investor-owned) that is a net importer of power and serves no more than two contiguous counties or one county and one contiguous city. It is unclear whether or not the financing for the landfill gas extraction/collection portion of the project can be included in this exemption.

> Local district heating and cooling — Tax-exempt status is provided for an energy project that sells steam, chilled water, and/or other thermal energy to two or more unrelated entities, which must be within two counties. The exemption covers the equipment used to generate the thermal energy.

Two additional exemptions may be applicable to landfill gas projects, although it is unknown whether any landfill gas projects have successfully used these exemptions:

> Prepayment of fuel supply — Tax-exempt status is provided for a governmental entity that purchases a long-term fuel supply such as gas reserves. Tax exempt status covers only the purchase of fuel supplies that are used in electric generation which serves a governmental entity.

> Solid waste disposal — Tax-exempt status is provided for facilities that burn solid waste fuel that has no market value as a saleable product.

The mechanics of issuing municipal bonds vary according to the type of bond, method of qualification, and the state or municipality in which the bond is issued. Qualified local tax or financial experts should be consulted for guidance.

6.2.4 Direct Municipal Funding

Landfill gas energy recovery projects can also be funded directly through the operating budget of a city, county, landfill authority, or other municipal government. Using this method, the costs of project development, equipment, and installation are expensed directly from the municipal budget, thus eliminating the need for outside financing or partnering. Typically this method is used to fund small projects that fit within the municipality's budget capabilities and priorities. Advantages and disadvantages are described in Box 6.4.

6.2.5 Lease Financing

Lease financing encompasses several leasing strategies in which the project operator/equipment user leases part or all of the energy project assets from the asset owner(s). Typically, lease arrangements provide the advantage of enabling the transfer of tax benefits such as accelerated depreciation or energy tax credits to an entity that can best use them. Lease arrangements commonly provide the lessee with the option, at predetermined time intervals, to purchase the assets or extend the lease. Several large equipment vendors

Box 6-4 Direct Municipal Funding — Advantages/Disadvantages

Advantages

- The need to meet tough lender's requirements (e.g., debt coverage, equity input, creditworthiness, contracts in place) is eliminated, although any municipal funding criteria must still be met.
- Expensing the project's funding requirements directly from the municipal budget will eliminate interest charges on project debt, making this generally the lowest-cost financing method.
- The project is not subject to delays caused by lenders' time requirements for evaluating the project and setting up the financing.

Disadvantages

- Usually the amount of municipal funds are limited, thus limiting the size of the project.
- The municipality loses the opportunity to share risks with other project partners.
- A public approval process may be required, making the project vulnerable to political forces.

have subsidiaries that lease equipment, as do some financing companies. There are several variations on the lease concept including:

> <u>Leveraged Lease</u> — In a leveraged lease, the equipment user leases the equipment from the owner, who finances the equipment purchase with external debt and possibly equity.
>
> <u>Sale-Leaseback</u> — In a sale-leaseback, the equipment user buys the equipment, then sells it to a corporation, which then leases it back to the user under contract.

Some of the disadvantages of lease financing include accounting and liability complexities, as well as the loss of tax benefits by the project operator/user.

6.2.6 Public Debt Financing

Financing power projects with public debt such as secured notes and bonds offered to institutional investors has recently received much attention from developers of large, conventional-fueled power projects. This approach is not likely to be an option for the typical landfill gas project, however, unless several high-quality landfill gas projects can be "packaged" together under single ownership. In this case, the debt could be raised for the package of projects through a single offering, and due diligence costs would be minimized by standardizing the projects. In order to qualify for public debt financing, a project must be rated at or near investment grade by rating agencies, have solid supporting contracts, and be large enough — approximately $100 million or more — to offset the transaction costs.

6.3 CAPITAL COST EFFECTS OF FINANCING ALTERNATIVES

Each financing method produces a different weighted cost of capital, which affects the amount of money that is spent to pay for a landfill gas power project and the price that is needed to cover project costs. The weighted cost of capital is dependent on the share of project funds financed with debt and equity, and on the cost of that debt or equity (i.e., interest rate on debt, ROR on equity). For example, in a project finance scenario with a debt/equity ratio of 80/20, an interest rate on debt of 9%, and an expected ROR on equity of 15%, the weighted cost of capital is 10.2%. Decreasing the amount of debt to 70% means that more of the project funds must be financed with equity, which carries a higher interest rate than debt, so the weighted cost of capital becomes 10.8%. Increasing the weighted cost of capital means that project revenues must be increased to pay the added financing charges. In contrast a lower weighted cost of capital lessens the amount of money spent on financing charges, which makes the project more competitive.

Among the four main financing methods presented above, direct municipal funding usually produces the lowest financing costs over time, while private equity financing produces the highest. Generally speaking, the four financing methods are ranked from lowest cost to highest cost as follows:

1) Direct municipal funding
2) Municipal bond financing
3) Project financing
4) Private equity financing

The advantage associated with direct municipal funding is created by the elimination of interest on debt, and by the low expected ROR. Municipal bond financing achieves its advantage through access to low-interest debt — assumed to be currently about 6.5% for tax-exempt bonds and 8.25% for taxable bonds [Snohomish, 1994]. Project finance produces a higher capacity price because funds are required to pay interest charges as well as ROR on equity (assumed to be 15%). Finally, private equity is the most expensive because it usually demands a higher ROR (assumed to be 18%) on equity than project finance, and equity makes up a larger share of the capital requirement.

Interest rates are an important determinant of project cost if the project sponsor decides to borrow funds, either through lending institutions or bond offerings, to finance the project. For example, raising interest rates by 1% would cause an increase of about 2% to 3% in the cost of generating electricity from a landfill gas project. Interest rates are determined by the prevailing rate indicators at a particular time, as well as by the project and lender's risk profiles. The interest rate for fixed-rate nonrecourse debt is usually determined by the lender's "spread" over an index such as U.S. treasuries. Likewise, the interest rate for floating-rate nonrecourse debt is based on a spread above variable indices such as the prime rate or the London Interbank Offered Rate (LIBOR). The lender's spread varies widely, but a landfill gas project with reliable gas availability, experienced participants, and a strong power purchase contract might expect a spread of 2.0% to 2.75% above the index. [Seifullin, 1995; DePrinzio, 1995]. Smaller projects requiring less than roughly $5 million of nonrecourse debt could also expect to pay an interest rate premium to compensate the lender for disproportionate transaction costs.

Table 6-2 illustrates the economic impact of different financing methods for the 5 million metric ton landfill example described in Chapter 5, which showed an IC engine power project with a capital cost of $1,675/kW. As Table 6-2 indicates, the levelized capacity price is more than doubled when comparing the low-cost municipal budget method with the high-cost private equity method (20% debt and 80% equity). [The capacity price refers to the initial cost of financing and building the project, levelized over the project life. This is the interest rate-sensitive portion of the project cost. Note that O&M and royalty expenses must be added, as described in Chapter 5, to determine the total project cost.] The more common private equity structure is the 50% debt case, and the more common project finance structure is the 80% debt case.

Table 6-2 Capital Cost Effects of Financing Approaches

Case: 5 million metric ton landfill (waste-in-place)
5 MW IC engine electric generating project

Installed Capital Requirement: 1,675 $/kW
Annual full load operating hours 7,008

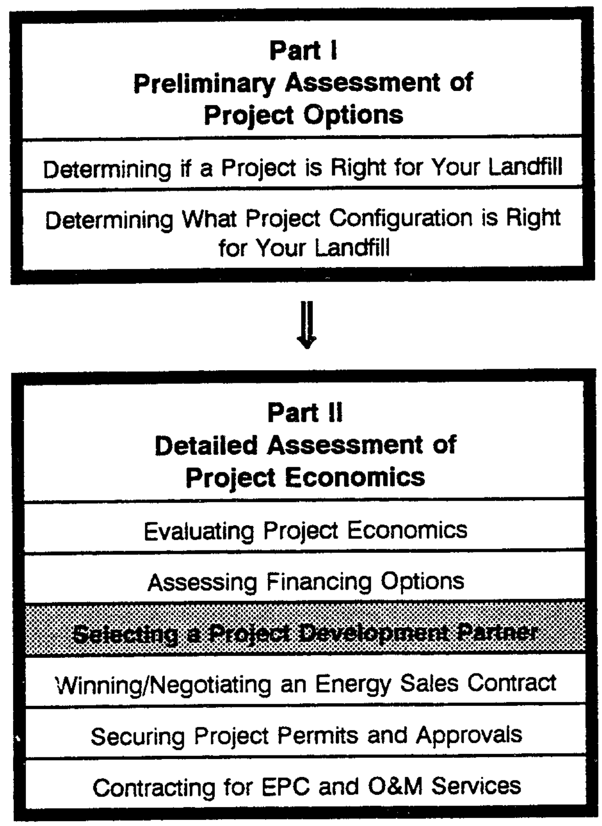
Financing Method	Interest Rate on Debt	After-tax Return on Equity	Weighted Cost of Capital	Capital Charge Rate	Levelized Capacity Price Required (¢/kWh)[a]
Private Equity Financing					
20% Debt/80% Equity	9.00%	18%	16.20%	0.225	5.38
50% Debt/50% Equity	9.00%	18%	13.50%	0.182	4.35
Project Finance					
70% Debt/30% Equity	9.00%	15%	10.80%	0.145	3.47
80% Debt/20% Equity	9.00%	15%	10.20%	0.136	3.25
Municipal Bond Funding					
Taxable Bond	8.25%	NA	8.25%	0.124	2.96
Tax-Exempt Bond	6.50%	NA	6.50%	0.111	2.65
Municipal Budget	NA	5%	5.00%	0.100	2.39

Notes:
[a] Levelized Capacity Price (¢/kWh) =
(Installed Capital Requirement) x (Cap Charge Rate)/(Annual hours)

This price only represents the capital cost portion of the project; other expenses such as O&M and royalties must be added to get to a total project cost.

7. SELECTING A PROJECT DEVELOPMENT PARTNER

The Project Development Process



The selection of a project development partner is a critical decision because the landfill owner often relies on the developer to manage the process of transforming a landfill energy project from a feasible idea on paper into a functioning, multi-million dollar facility. Some landfill owners have the expertise, resources, and desire to lead the development effort on their own, but even in this case, choosing the right development partner(s) can greatly improve the likelihood of project success. This chapter provides guidance to landfill owners who are attempting to determine: (1) the role that they might take in the development process; and (2) the right partner to get the project developed, financed, and built.

From the landfill owner's perspective, there are three general ways to structure the development and ownership of a landfill gas energy project:

(1) <u>Develop the project internally</u> — Landfill owner manages the development effort and maintains ownership control of the project. This approach maximizes economic returns to the owner, but also places most of the project risks on the owner (e.g., construction, equipment performance, financial performance).

(2) <u>Team with a pure project developer</u> — Landfill owner selects a qualified developer to develop and build the project. This option shifts most risks onto the developer, but the landfill owner usually gives up control, ownership rights, and some or all of the potential for financial returns. A variation on this option is selecting a developer to provide the landfill owner with a "turnkey" plant, which is built by the developer but owned by the landfill owner.

(3) <u>Team with a partner</u> — Landfill owner teams with an equipment vendor, engineering/procurement/construction (EPC) firm, industrial company, or fuel company to develop the project and to share the risks and financial returns.

With these structures in mind, a landfill owner can determine his or her desired role in the project development process by considering two key questions:

- Should the landfill owner self-develop or find a partner?

- If a partner is desired, what kind of partner best complements the landfill owner and the project?

The landfill owner can answer the first question by conducting a frank examination of his or her own expertise, objectives, and resources. The second question is more complicated because it entails an assessment of the landfill owner's specific needs and a search for the right partner to complement those needs.

Figure 7.1 illustrates the process of determining the best development approach. As it indicates, in cases where the landfill owner wants to be involved in the project development process, a number of issues must be considered. These issues are discussed in the following sections.

7.1 THE PARTNER/NO PARTNER DECISION

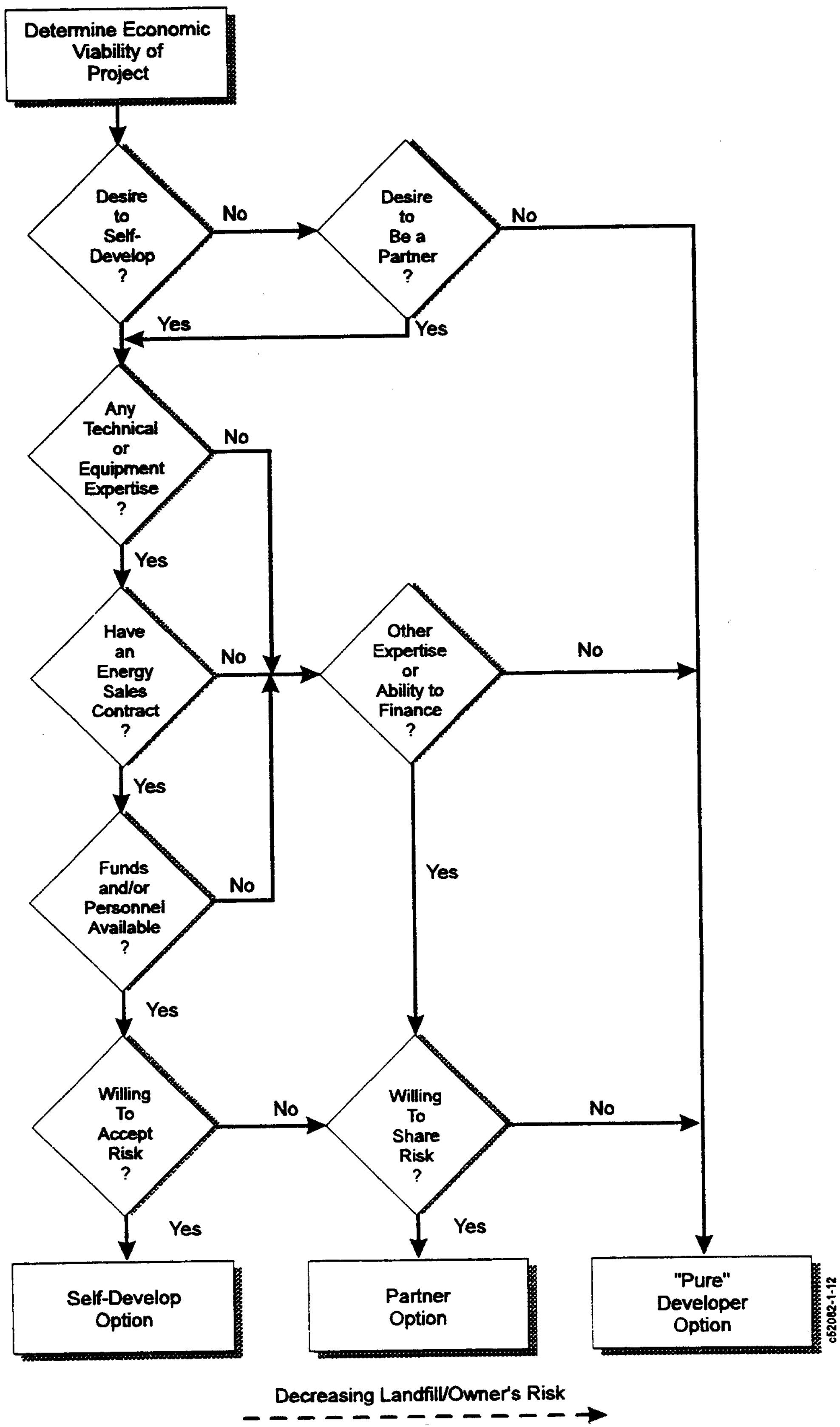
Before deciding whether to develop the project internally, the landfill owner must understand the role of the project developer, which is outlined in Box 7.1. Next, an assessment of the landfill owner's objectives, expertise, and resources will determine whether or not the owner should undertake project development independently or include a partner/developer. A landfill owner who is a good candidate for developing a project alone will have many of the following attributes:

- strong desire to develop a successful, profitable energy project;
- willingness to accept project risks (e.g., construction, equipment, permitting, financial performance);
- expertise with technical projects (e.g., power, infrastructure, or industrial) or energy equipment;
- high confidence level regarding landfill gas quantity and quality (i.e., modeling or test wells have been completed);
- possession of a power sales agreement with a local electric utility, an electric consumer, a gas purchaser, or sufficient internal demand; and
- funds and personnel available to commit to the development process.

In addition, other attributes may improve a landfill owner's likelihood of success in developing a project in-house. Ownership or control of multiple landfills, for example, may be desirable because it will enable the owner to leverage his/her time and resources spent. Similarly, a strong desire for new business opportunities and/or visibility may be beneficial. An example of the type of landfill owner that fits this profile is a municipal utility district that might have responsibility for local electricity procurement and distribution, water supply, and/or sewage treatment, in addition to landfill management.

If the landfill owner is uncertain about several of the attributes listed above, particularly the desire to develop, the willingness to take significant risks, and/or their level of technical

Figure 7.1 The Developer/Partner Selection Process



Box 7.1 The Role of the Project Developer

Determine Landfill Gas Supply — If the landfill owner has not already completed this step, then the first development step will be to determine the landfill gas supply using calculations, computer modeling, and/or test wells.

Scope Out the Project — Project scoping includes early-stage tasks such as selecting a location for the equipment, sizing the energy output to the landfill gas supply, contacting potential energy customers, and selecting key equipment.

Conduct Feasibility Analysis — Feasibility analysis includes detailed technical and economic calculations to demonstrate the technical feasibility of the project and estimate project revenues and costs.

Select Equipment — Based on the results of the feasibility analysis, primary equipment is selected and vendors are contacted to assess price, performance, schedule, and guarantees.

Create a Financial Pro Forma — A financial pro forma is usually created to model the cash flows of a project and to predict financial performance.

Prepare the Bid — If the project must bid in a utility solicitation in order to obtain a power sales agreement (PSA), a responsive bid package will be prepared and submitted.

Negotiate the Power Sales Agreement (PSA) — The terms of the PSA must be negotiated with the purchasing electric utility.

Negotiate the Gas or Steam Sales Agreements — For projects that intend to sell landfill gas or steam, agreements must be negotiated with the energy customers.

Obtain Environmental and Site Permits — All required environmental permits and site permits/licenses must be acquired.

Gain Regulatory Approval — Some power projects must obtain approval from state regulators or certification by the Federal Energy Regulatory Commission (FERC).

Negotiate Partnership Agreement(s) — If project ownership is to be shared with partners or investors, then the project will require negotiation of ownership agreements.

Secure Financing — Securing financing for the project is a critical task that requires specific expertise, depending on the type of financing being used.

Contract with Engineering, Construction, Operating Firms — Firms must be selected and contracts and terms negotiated.

expertise, then he or she might instead choose a partner. The following are several good reasons to develop the project with a partner:

- limited desire to lead the development effort;
- limited technical resources and/or experience;
- need to share or avoid specific project risks;
- difficulty financing the project alone;
- inability to dedicate personnel or time to the development effort;
- project development outside the scope of organizational charter; and
- difficulty spending funds to determine landfill gas quantity.

The questions in Figure 7.1 illustrate other critical considerations in making the partner/no partner decision.

Most landfill owners choose to bring in a developer to build and/or own the energy recovery project, either alone or in partnership with the landfill owner or others. A recent survey of existing and planned landfill gas energy recovery projects shows that about 78% of gas collection systems and 88% of gas processing/energy recovery systems are owned by private firms or in partnership with private firms [Berenyi and Gould, 1994].

7.2 SELECTING A DEVELOPMENT PARTNER

Once the decision has been made to include a project development partner, the next step is to decide what type of partner to select. There are several different types of development partners to choose from, so the landfill owner should look for a partner that provides the best match for the specific energy project and the landfill owner's in-house capabilities. Five general types of project development partners, listed in order of decreasing scope of services, include:

<u>Pure Developer</u> — A firm primarily in the business of developing, owning, and/or operating landfill gas energy projects. Some developers focus on landfill gas power projects, while others may be involved in a broad project portfolio of technologies and fuel types. Pure developers usually will own the completed landfill gas energy facility, but sometimes a developer will build a turnkey facility for the landfill owner.

<u>Equipment Vendor</u> — A firm primarily in the business of selling power or energy equipment, although it will participate in project development and/or ownership in specific situations where its equipment is being used. The primary objective of this type of developer is to help facilitate purchases of its equipment and services.

<u>EPC Firm</u> — A firm primarily engaged in providing engineering, procurement, and construction services. Some EPC firms have project development groups that develop energy projects and/or take an ownership position.

Fuel Company — A firm primarily engaged in providing fuels and/or fuel procurement services. These firms may have project development subsidiaries or agree to take a specific development role such as securing a customer for the landfill gas.

Industrial Company — A firm primarily engaged in manufacturing a product and managing an industrial manufacturing facility. Some industrial firms have power project development subsidiaries or may take a specific role such as guaranteeing energy purchases or assisting with financing.

Ideally, a developer or partner can be identified that fills specific project needs such as ability to secure a power purchase contract, finance the project, or supply equipment. Issuing a request for proposals (RFP) is often a good way to attract and evaluate partners.

A partner reduces risks to the landfill owner by bearing or sharing the responsibilities of project development, although the amount of risk reduction provided depends on the type of partner chosen. For example, a "pure developer" partner will usually take the risk/responsibility of construction, equipment performance, environmental permitting, community acceptance, energy sales agreements, and financing, whereas an equipment vendor partner may only bear the risks of equipment performance.

7.2.1 Selecting a Pure Developer

Selecting a pure project developer to manage the development process and own the landfill gas energy project is a good way for the landfill owner to shed development responsibility and risks, and get the project built at no net cost to the landfill. In addition, the pure project developer typically provides the landfill owner with the strongest development skills and experience, since pure developers focus exclusively on landfill gas projects. Other reasons for selecting a pure project developer include:

- the developer's skills and experience may be invaluable in bringing a successful project online;

- some developers are ready to invest equity or have access to financing; and

- the developer might be in possession of a power sales agreement that was previously won and/or negotiated with a nearby electric utility.

In return for accepting project risks, most developers require a significant share of project profits, potentially up to 100 percent. As a result, the landfill owner generally loses control and ownership of the energy project. Such an ownership arrangement may be appropriate for a particular landfill if, for example, development of an energy recovery system is the lowest cost method for complying with environmental regulations. It may also be necessary to involve a developer in order to take advantage of IRS Section 29 tax credits (see Chapter 5 for more on tax credits). If the developer becomes the sole or controlling owner, however, he/she will tend to make decisions to protect his/her interest in the project, namely the energy revenues, and may be less concerned with the landfill owner's priorities such as controlling landfill gas migration.

The case of the I-95 Landfill in Lorton, Virginia illustrates the key issues involved in taking the pure developer approach. As described in Box 7.2, this landfill partnered with a pure developer to develop a successful energy recovery project. By carefully structuring its contract

Box 7.2 Developer Selection at I-95 Landfill

The I-95 Landfill Project in Lorton, Virginia illustrates one landfill owner's successful experience in selecting a project developer. The I-95 Landfill Project is a 17.5 million ton sanitary landfill that supports a 6,400-kw electric generating system, using 8 Caterpillar internal combustion engines. The landfill gas collection system is owned and operated by Fairfax County and the electric generating equipment is owned by Landfill Energy Systems, a division of Michigan Cogeneration Systems.

Fairfax County found that selecting a pure developer resulted in the successful completion of the landfill gas power project. Fairfax County hired a consultant to assess the landfill gas quantity and quality, then issued a request for proposals (RFP) to select a project developer. The developer ultimately selected to build the project had experience with other landfill gas projects, a power sales agreement with the local utility, and the ability to finance the project.

A thoughtful contracting approach eliminated potential conflicts between the developer and landfill owner. Fairfax County was most concerned with controlling landfill gas migration and emissions, while the developer wanted to optimize gas output for power generation. The two parties recognized that the best gas collection strategy for minimizing gas migration is often different from the strategy that maximizes power output. In a worst case scenario where an uncooperative developer owns the gas collection system, a landfill owner might be forced to drill collection wells at the landfill perimeter to control offsite migration, which could draw gas away from the developer's collection wells. To avoid this potential scenario, Fairfax County opted to keep control of the entire collection system and now supplies landfill gas to Landfill Energy Systems' electric generating equipment.

with the developer, the landfill owner was able to ensure that safety and other concerns were given top priority by the developer.

Arranging for a turnkey project represents a variation on the pure developer approach. The turnkey option is a good approach if the landfill owner wants to retain energy project ownership or the project's return on investment does not meet the developer's criterion. In a turnkey approach, the developer assumes development responsibility and construction risk, finances and builds the facility, and then transfers ownership to the landfill owner when the facility is complete and performing up to specifications. In return, the developer can receive a fee, a share of project proceeds, gas rights, and/or a long-term operation and maintenance contract. Sometimes the landfill owner will use municipal bonds to finance the project, so the developer essentially develops and builds the project for a fee. The turnkey approach enables each entity to contribute what it does best: the developer accepts development, construction, and performance risk; and the owner accepts financial performance risk.

7.2.2 Selecting a Partner (Equipment Vendor, EPC Firm, Fuel Firm, Industrial)

Selecting a development partner who is not a pure developer is a good choice if two key conditions exist:

(1) The landfill owner wants to keep management control of the project and has sufficient in-house expertise and resources to do so; and,

(2) The partner can fulfill a specific role or provide equipment for the project.

In this case, the landfill owner must have a clear desire to manage the development process and should have sufficient technical experience, personnel, and development funds to support the development effort. The owner should also have a relatively high confidence level regarding landfill gas production capability, as well as a willingness to accept a significant share of the project's risks (e.g., financial, environmental permitting, community acceptance). Other factors that could make the partnering approach an appropriate choice include the ownership of a power or energy purchase agreement, or control of multiple landfills that could each be developed into a landfill gas project, thus leveraging the time and resources invested.

There are four basic types of firms that enter into partnership agreements with landfill operators: equipment vendors, EPC firms, fuel suppliers, and industrial companies. Each of these firms have different strengths and will assume different types of project risk. The key characteristics of these types of firms are summarized below.

<u>Equipment vendors</u>: Some equipment vendors such as engine and turbine manufacturers become partners in energy projects, including landfill gas projects, as a way to support the sale of equipment and services to potential customers. Equipment vendors may assist in financing the project, and are often willing to accept the equipment performance risk over a specified length of time for the equipment that they provide. However, equipment vendors typically do not take on responsibilities beyond their equipment services, and they generally want to sell their interest in a project as quickly as possible after the project has been built.

<u>EPC firms</u>: Similarly, some of the larger EPC firms will become partners in power projects with the objective of selling services and gaining a return on equity and/or time invested. However, this type of potential partner tends primarily to pursue large fossil-fueled projects where the EPC's strength as a manager of large, complex projects is more valuable.

<u>Fuel suppliers</u>: A fuel supplier or marketing company can be a potential development partner in landfill gas projects where marketable gas is the energy product for sale. For example, a local natural gas distribution company might become a partner to gain access to a local, low cost gas supply. This type of partner would typically take a very limited role such as guaranteeing a market for the landfill gas or owning the gas collection and processing systems. However, several natural gas suppliers and pipeline companies also have power project development subsidiaries that resemble pure developers in terms of experience and capabilities, and that may be willing to take on a larger role in the project.

<u>Industrial companies</u>: Finally, an industrial company might become a partner in the landfill gas project if it has significant use for the landfill gas or derived energy (i.e., electricity, steam). The industrial company is likely to prefer a limited involvement in the development process.

7.3 EVALUATING INDIVIDUAL FIRMS

Once the right partnering strategy has been identified, the landfill owner should review the capabilities of individual firms that meet the owner's general needs. When selecting a firm to become a development partner, there are several qualities and capabilities that landfill owners should look for, including:

- previous landfill gas project experience;
- a successful energy project track record;
- access to capital and/or financing; and
- in-house resources (e.g., engineering, finance, operation) including experience with environmental permitting and community issues.

Information about individual firm qualifications can be gained from annual reports, brochures, and project descriptions, as well as from discussions with references, other landfill owners, and engineers. Potential warning signs include lawsuits, disputes with landfill owners, and failed projects, although a few failed development efforts and/or underperforming projects can normally be found in the portfolio of any project developer. Published information can be obtained by researching trade literature, through legal information services, and through computer research services.

7.3.1 Issuing a Request for Proposals (RFP)

A landfill owner may find it advantageous to issue an RFP for a developer or partner, because if the RFP is prepared correctly, respondents will generally offer creative, informative, and useful responses. The RFP process is a good way to screen proposals and focus on the best one(s) for further discussions and negotiation.

A landfill owner who plans on issuing an RFP should carefully examine his needs and ask respondents to propose ways to meet those needs or solve problems. For example, if a landfill gas energy project needs a power sales agreement or energy sales contract, then the landfill owner should state in the RFP that the ability to secure one of these agreements is a central selection criterion. Likewise, if ability to secure financing or environmental permits is important, that should also be stated in the RFP. In this way, respondents will be encouraged to offer innovative proposals that meet the project's specific needs.

In general, RFP respondents should be asked to provide the following information:

- Description of the energy project and available options;
- Scope of services being offered (e.g., developer, owner, operator);
- Project development history and performance;
- Pricing and escalation (e.g., royalties/payments to landfill owner, electricity price, energy prices) including buyout price and terms;
- Turnkey facility bid (if appropriate);

- Plan for obtaining energy revenues (e.g., PSA with utility, gas sales contract, steam contract);
- Technology description and performance data;
- Well placement strategy (if applicable);
- Well field operations responsibility;
- Responsibility for environmental compliance;
- Environmental permitting and community approval plan;
- Financing plan;
- Schedule; and
- Operation and Maintenance plan.

Landfill owners should state in the RFP that the owner reserves the right to select none, one, or several respondents for further negotiation, depending on the proposal's responsiveness to the owner's criteria. Appendix D contains a sample RFP that was issued by one landfill. This particular RFP is not very detailed; therefore, the respondent would have some leeway in preparing his or her bid package.

7.3.2 Preparing a Contract

Once the partner has been selected, the terms of the partnership should be formalized in a contract. The contract should accomplish several objectives, including allocating risk among project participants. Some of the key elements of a partnership contract are listed in Box 7.3.

As Box 7.3 indicates, contracting with a developer or partner in a landfill gas energy project is a complex issue. Each contract will be different depending on the specific nature of the project and the objectives and limitations of the participants. Because of this complexity, it is imperative that the landfill owner consult in-house counsel or hire a qualified attorney to serve as a guide through the contracting process.

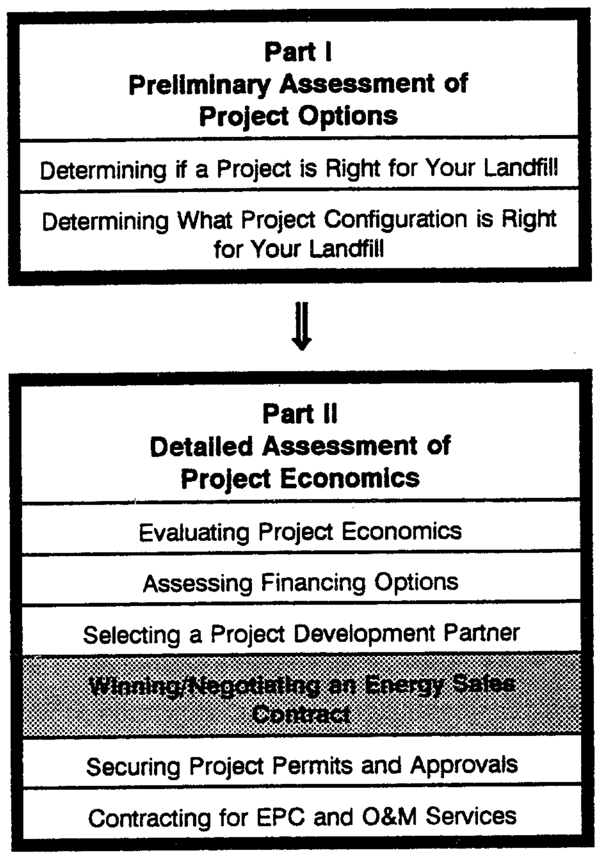
Box 7.3 Elements of a Partnership Contract

The contract between the landfill owner and the developer or partner should describe in detail the responsibilities of each party, any payments to be made, and any warranties and/or guarantees. Some specific items that should be addressed include:

- Ownership shares;
- Allocation of development responsibility;
- Decisionmaking rights;
- Commitments of equity, financing, equipment, and/or services;
- Payments, fees, royalties;
- Hierarchy of project cash distributions;
- Allocation of tax credits;
- Allocation of specific risks (e.g., equipment performance, gas flow);
- Penalties, damages, bonuses;
- Schedule and milestones;
- Termination rights clause;
- Buy-out price; and
- Remedies/arbitration procedures.

8. WINNING/NEGOTIATING AN ENERGY SALES CONTRACT

The Project Development Process



An energy sales contract will determine the success or failure of a project, since it secures the project's source of revenue. Therefore, successfully obtaining a contract is the crucial milestone in the project development process. This chapter provides a guide to the issues involved in bidding for, winning, and negotiating an energy sales contract. Because contract negotiation is often a complex process, owner/operators and developers may want to consult an expert for further information and guidance.

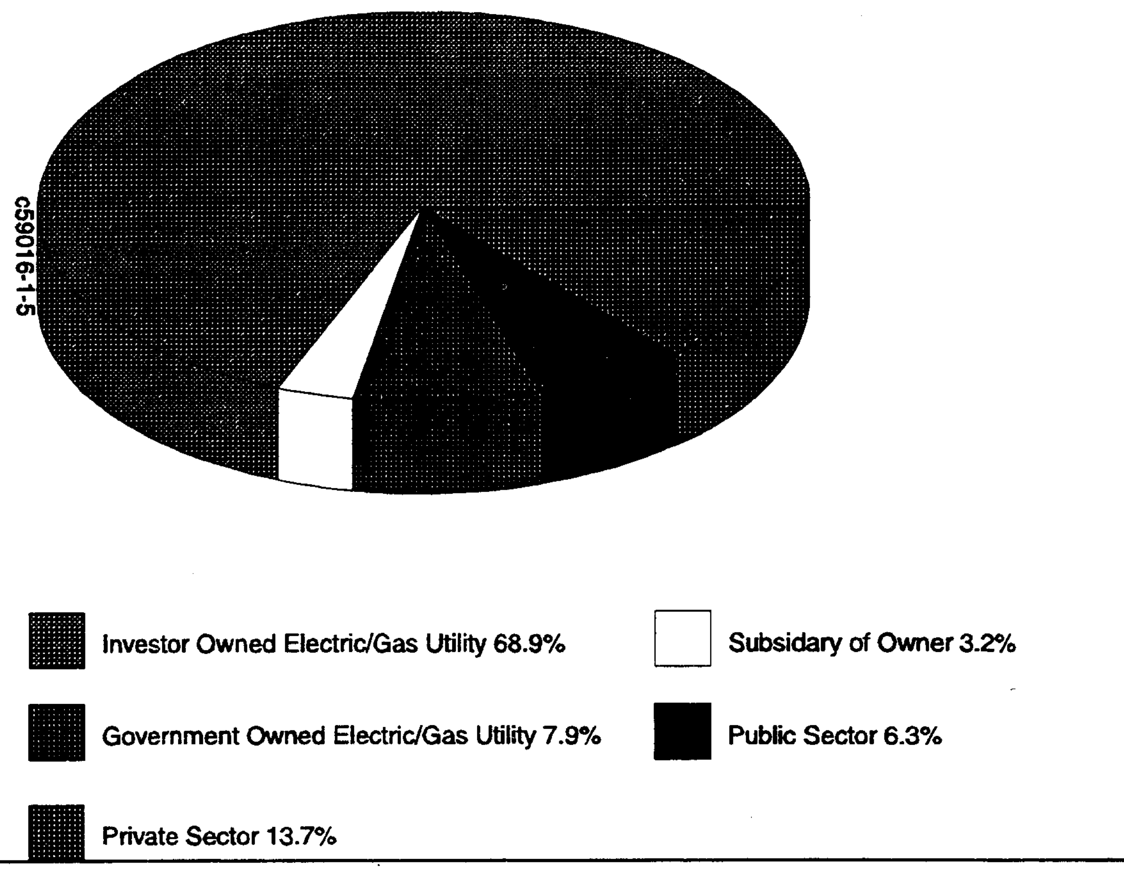
Depending on the configuration of the landfill gas-to-energy project, one of two types of energy sales contracts may be obtained:

Power sales contract — A long-term sales contract is necessary to ensure revenues for power projects, and is usually required to obtain financing. The power sales contract may be negotiated with an electric utility and/or a local end user. Additionally, if the sales contract is with a utility other than the one directly interconnected to the project, then arrangements with the local utility will be necessary to transport the power to the buyer. If the landfill gas-to-energy project will also sell steam or thermal energy, then the project must have a steam sales contract with the end user. Such contracts are directly negotiated between the project developer and the end user.

Gas sales contract — A gas sales contract is required when medium- or high-Btu gas sales are made. In cases where medium-Btu gas is sold as boiler (or other industrial equipment) fuel, a contract between the gas purchaser and the project developer is necessary. Such contracts are the result of direct negotiation. If high-Btu gas sales are made, the gas sales contract is typically between the local gas distribution company and the project developer, although a contract with a gas marketer is also possible.

The majority (about 69%) of existing landfill gas-to-energy projects have obtained power and gas sales contracts with investor-owned utilities. The remaining projects have contracts with private sector customers such as industrial facilities (14%), government-owned gas or electric utilities (8%), other public sector buyers, or subsidiaries of landfill gas plant owners [Berenyi and Gould, 1994]. These results are shown in Figure 8.1.

Figure 8-1 Types of Companies that Contracted with Landfill Gas Energy Recovery Projects for the Purchase of Gas or Electricity in 1994

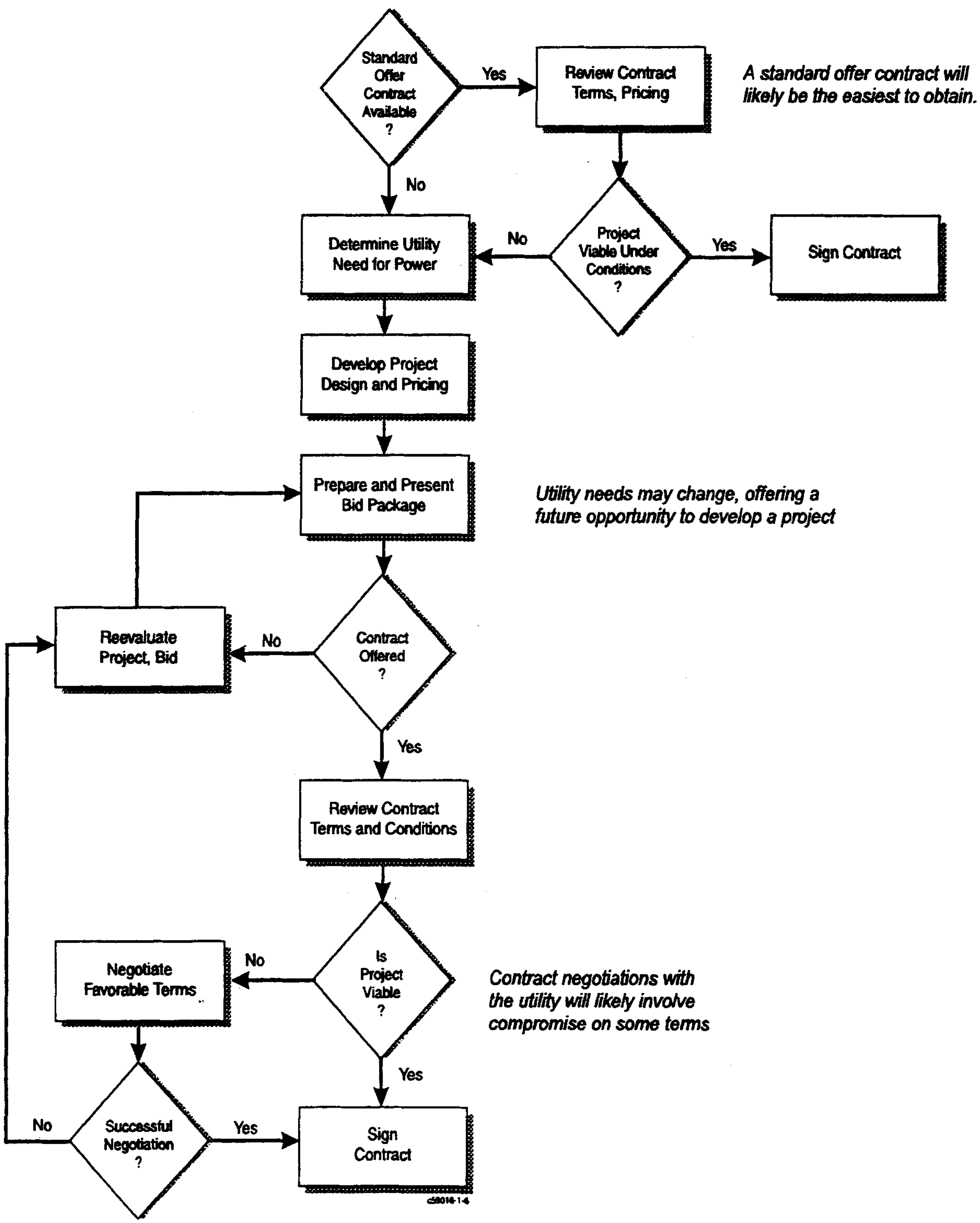


A landfill owner can either pursue a contract on its own or bring in an experienced project developer who will take the responsibility of obtaining a contract. This chapter provides insights on how landfill owners and project developers can win energy sales contracts with appropriate energy buyers, and contains a detailed outline of a power sales bid to an electric utility. Because the terms and conditions of the energy sales contract will determine the project's long-term viability, critical contract provisions are also briefly discussed.

8.1 POWER SALES CONTRACTS

There are two common types of power sales contracts: (1) standard offers and (2) power sales agreements either negotiated or won through a competitive bidding process. Figure 8.2 illustrates the steps involved in obtaining a power sales contract. As the figure indicates, standard offer contracts with local utilities are generally preferred when they are available at favorable terms. The majority of existing landfill gas power projects hold standard offer contracts with their local utilities because in the past they have been the easiest to obtain (however, standard offer contracts are disappearing and becoming more difficult to obtain). In cases where standard offers are either not available or not appropriate, however, power sales agreements may be sought. It is likely that the power sales agreement will be sought from the local utility. However, it may be possible to negotiate an agreement with a utility other than the one directly interconnected to the project, or to negotiate a contract with an end use consumer.

Figure 8-2 Winning/Negotiating An Energy Sales Contract (Power Sales Agreement)



Key issues related to power sales contracts are discussed below. Also discussed are the considerations to be taken into account when the power sales contract is negotiated with an entity other than the interconnected utility and wheeling arrangements are necessary.

8.1.1 Standard Offer Contracts

A standard offer contract is sometimes available from electric utilities that forecast a need for additional generating capacity. The standard offer contract specifies the terms and price that the utility will grant to eligible projects. Many standard offers require that projects be certified as "qualifying facilities" as defined by the Public Utilities Regulatory Policies Act (PURPA). Landfill gas projects are eligible to be qualifying facilities.

The standard offer price typically includes both a capacity payment and a variable energy payment. Standard offer contract prices are based on the utility's avoided costs; that is, the cost the utility would otherwise incur in providing electricity generating capacity and energy if it did not purchase this capacity and energy from the qualifying facility (QF). Most electric utilities are required to calculate their avoided cost and have it reviewed and approved by their state regulatory authority.

Many utilities go through cycles where capacity is needed, contracts are offered, contracts are signed, and then the standard offer is withdrawn until more capacity is needed. During the periods when additional generating capacity is not needed, utilities are likely to offer only a variable avoided short-term energy payment. Unfortunately, avoided energy payments are often too low to economically justify developing a project. For example, 1992 average U.S. utility avoided energy costs were in the 2.9 to 3.5 ¢/kWh range [ICF, 1994]. Even though a standard offer contract may not be available, project developers should still approach utilities to see if a contract can be negotiated.

How to Qualify for Standard Offers

In order to qualify for most standard offer contracts, a project must conform to the guidelines set by PURPA. Under PURPA, an electric utility is obligated to buy electricity from a power project at its current avoided cost rate if the project is granted QF status by the Federal Energy Regulatory Commission (FERC) as either a "small power producer" or a "qualifying cogenerator." PURPA prohibits utilities or utility holding companies from having more than 50 percent ownership in QF projects, and it stipulates size and fuel requirements as follows:

> <u>Small power producer</u> — Small power producers must be no more than 80 MW in size and must use a primary energy source of biomass, waste, renewable resources, or geothermal resources. Most landfill projects would be considered small power producers.[1]
>
> <u>Qualifying cogeneration facility</u> — A cogeneration QF must produce useful thermal energy as well as electricity for sale to the utility. There is no size limitation; however, at least five percent of the cogeneration QF's total energy output must be provided to

[1] There are proposals within Congress to lift the 80 MW size limit. There is also some debate as to whether PURPA should be repealed completely.